Towards high efficiency, high power density InGaAs TPV cells

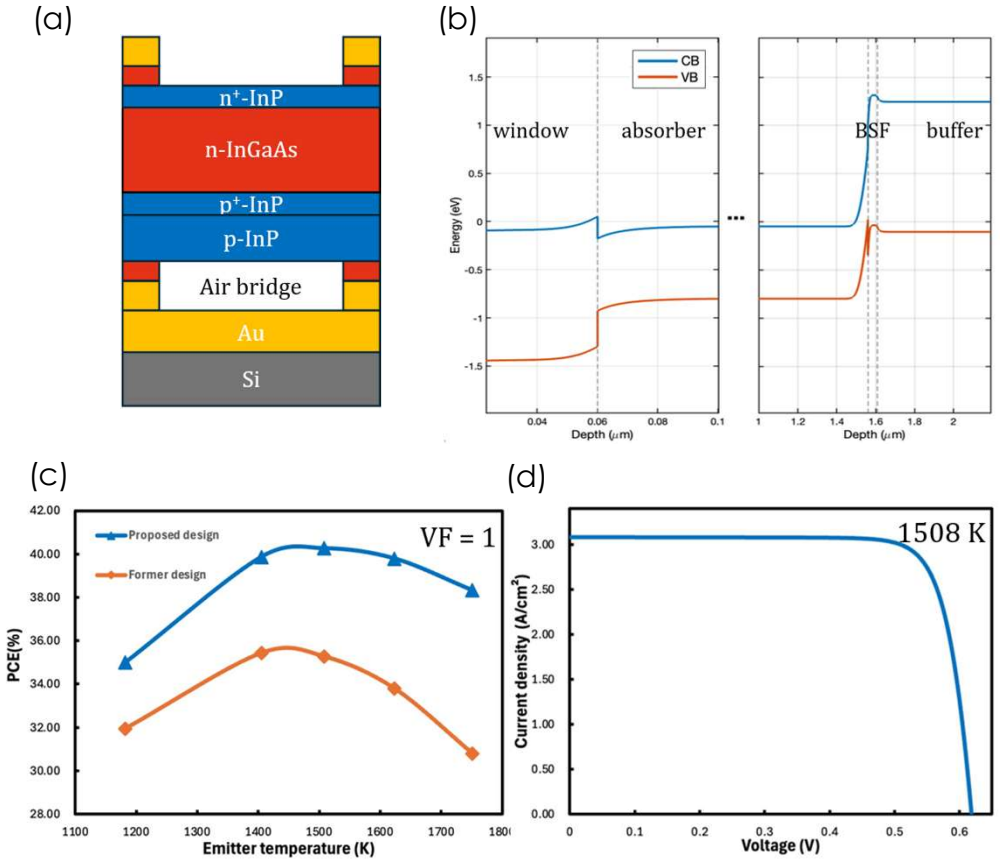

Figure: (a) Proposed n/p InGaAs TPV cell structure. (b) Band diagram of the proposed structure. (c) Simulated PCE comparison at a view factor VF = 1. (d) Simulated JV curve under 1508 K blackbody illumination.

Objective

➢ To develop high efficiency, high power density $In_{0.53}Ga_{0.47}As$ TPV cells by integrating air bridge technology with an optimized n/p cell structure for practical high temperature TPV energy conversion.

Impact

High efficiency $In_{0.53}Ga_{0.47}As$ TPV cells can generate clean, cost-effective power by directly converting high temperature thermal radiation into electricity for portable generators, industrial waste heat recovery, and radioisotope systems. Our group previously demonstrated p/n InGaAs TPV cells with 36% power conversion efficiency (PCE) at 1753 K, view factor (VF) = 0.38, and approximately 98% out-of-band reflectance using an air bridge back surface reflector. In this work, we design and fabricate an n/p InGaAs cells to reduce Zn diffusion, lower series resistance, and improve top-layer lateral conduction. This new design improves TPV cell PCE and power density under high VF operation for practical high temperature TPV systems.

Facilities and Methods Used

- Silvaco TCAD simulation tool
- LNF facilities

Funding

- National Science Foundation
- Army Research Office

Collaborators

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